



# UNIVERSIDADE FEDERAL DO CEARÁ

**FEDERAL UNIVERSITY OF CEARÁ  
OFFICE OF THE VICE PROVOST FOR UNDERGRADUATION (PROGRAD)  
COORDINATION FOR PROJECT AND CURRICULUM DEVELOPMENT  
CURRICULUM DEVELOPMENT DIVISION**

**1. Academic unit offering the curricular component** (Faculty, Center, Institute, Campus):

Center of Technology

**2. Department offering the curricular component** (when applicable):

Teleinformatics Engineering Department

**3. Undergraduate course(s) offering the curricular component**

Code of the Course	Name of the Course	Course Degree <sup>1</sup>	Curriculum (Year/Semester)	Nature of the Component <sup>2</sup>	Semester of Offer <sup>3</sup>	Habilitation <sup>4</sup>
91	Telecommunications Engineering	Bachelor	2015.1	Optional	-	-

**4. Name of the curricular component:**

Inteligência Computacional Aplicada

**5. Code of the curricular component** (filled by PROGRAD):

TI0125

6. Prerequisites	No ( )	Yes (x)	
		Code	Name of the curricular component / activity
		TI0116	Signals and Systems

7. Corequisite	No (x)	Yes ( )	
		Code	Name of the curricular component / activity

8. Equivalences	No ( )	Yes (x)	
		Code	Name of the curricular component / activity
		TI0077	Applied Computational Intelligence

**9. Day period of the curricular component** (more than one option can be selected):

Morning       Afternoon       Night

<sup>1</sup> Fill with *Bachelor (Engineer), Licenciante, or Technologist.*

<sup>2</sup> Fill with *Mandatory, Optional, or Elective.*

<sup>3</sup> Fill when mandatory.

<sup>4</sup> When elective, fill with the habilitation or emphasis to which the curricular component is linked.

**10. Regime of the curricular component:**

(x) Semester

( ) Yearly

( ) Modular

**11. Justificatory for the creation/regulamentation of this curricular component**

Fuzzy logic, neural networks and genetic algorithms are today a set of tools, with proven efficiency, in the solution of several engineering problems.

**12. Objectives for the curricular component:**

To enable students to employ neural logic methodologies and artificial neural networks to solve engineering problems.

**13. Syllabus:**

Introduction to intelligent systems. Concept of fuzzy sets. Fuzzy logic fundamentals. Fuzzy systems: concepts and implementation. Artificial neural networks: mathematical model of the neuron, neural networks with layered structure and recurrent networks. Back propagation algorithm. Introduction to genetic algorithms. Engineering applications.

**14. Program:**

1. **Fuzzy sets:** concept, basic properties, logical operations, fuzzy relationship, projection and cylindrical extension, max-min compositional rule, extension principle, T-norms and S-norms.
2. **Fuzzy logic:** fuzzy variables and linguistic variables, compositional rule of inference, fuzzy systems, fuzzifying and de-fuzzifying processes, design stages of a fuzzy system.
3. **Applications of fuzzy logic in control:** design of a level control system, flow and temperature control, semaphore control by demand.
4. **Introduction to artificial neural networks:** definitions, neuron model, basic architectures, knowledge representation, learning paradigms.
5. **Layered networks:** the perceptron, supervised learning, competitive learning, limitations of single layer networks, multi-layer networks, back-propagation algorithm.
6. **Feedback networks:** recurrent networks, discrete networks of Hopfield.
7. **Basic applications:** pattern classification, character recognition, interpolation.
8. **Genetic algorithm:** introduction, GA components, genetic operators, selection methods, reproduction methods, basic applications.

**15. Workload description**

Number of Weeks:	Number of Credits:	Total Workload in Hours:	Theory Workload in Hours:	Practice Workload in Hours:
16	04	64	64	-

**16. Basic bibliography:**

- 1- Pimentel, C.[2002] Introduction à Lógica Nebulosa (apostila)
- 2- Wang, Li-Xin.[1997], A Course in Fuzzy Systems and Control . Prentice Hall.
- 3- Simon Haykin [1994], Neural Networks, A Comprehensive Foundation, McCPC.
- 4- Davis, L. [1991], Handbook of Genetic Algorithms, Chapman and Hall.

**17. Complementary bibliography:**

- 1- Earl Cox, Michael O'Hagan [1998], The Fuzzy Systems Handbook: A Practitioner's Guide to Building, Using, and Maintaining Fuzzy Systems. 2nd edition, Morgan Kaufmann.
- 2- W. Pedrycz, F. Gomide [2007], Fuzzy Systems Bacheloring: Toward Human-Centric Computing, Wiley-IEEE Press.
- 3- Fausett, L [1994], Fundamentals of Neural Networks. Prentice Hall.
- 4- Simon Haykin [2008], Neural Networks and Learning Machines, 3rd edition, Prentice Hall.
- 5- Dan Simon [2013], Evolutionary Optimization Algorithms, 1st edition, Wiley.